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RESEARCH ON THE LATENT STRUCTURE OF PTSD

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For over twenty years, trauma researchers have used factor analysis to better understand PTSD. A recent search of the PILOTS database yielded just over 60 factor analyses of some 20 different PTSD measures, including alternative language versions. In the earliest studies—and, to some extent, still today—the latent structure of PTSD was examined using exploratory strategies. As trauma theory has matured, empirical findings have accumulated, and methods have advanced, exploratory approaches have been increasingly replaced with confirmatory approaches. Given the impending DSM-V, it is timely to take stock of what has been learned and the implications for revisions of our diagnostic guidelines and our thinking about PTSD.

Researchers often draw a rigid distinction between the structure of a measure of PTSD and the structure of PTSD itself, but this distinction is more apparent than real. A viable construct for explaining human behavior must enjoy many good indicators, and evidence for validity is best demonstrated by triangulation across multiple indicators. Therefore, the structure of a quality measure of PTSD is tied directly to the structure of PTSD itself. It is not very meaningful to talk about the structure of a test as something distinct from the structure of the construct being assessed. Factor analytic results bear on the validity of and provide evidence for the structure of the construct, and construct definitions should evolve based on empirical findings.

We begin with a brief conceptual explanation of factor analysis. We then summarize some of the more prominent factor analytic studies of PTSD. We present the labels of components or factors exactly as specified by the original researchers and provide citations for the measures they used in the reference list. We close with conclusions and recommendations for future research.

Factor Analysis

A first important distinction is that between principal components analysis and common factor analysis. Principal components analysis is a data reduction procedure to determine a minimum number of components (linear combinations of observed variables) that explain a maximum amount of variance in the observed variables. Common factor analysis, on the other hand, identifies the latent structure (set of factors or hypothetical constructs) that is responsible for covariation among the observed variables. Although the two approaches can yield comparable findings under certain conditions, they are quite different in their purposes and in their mathematical and statistical underpinnings. Common factor analysis is the preferred approach to uncover the structure that underlies the pattern of associations among PTSD symptoms. Moreover, the statistical properties associated with common factor analysis may allow one to derive goodness-of-fit indices and standard errors for factor loadings from which critical ratios or confidence intervals can be calculated.

Common factor analysis subsumes a range of procedures that vary in the specificity imposed on the solution. At one extreme are traditional exploratory methods wherein both the number of extracted factors and, as a consequence, the communalities (proportions of variance in the variables accounted for by the factors) are arrived at using external and ad hoc decision rules, such as a scree test. For these methods, there is little guidance concerning the solution's appropriateness, but they are a worthy first step to understanding latent structure. Then again, by specifying a guess at the number of factors, making assumptions about multivariate normality, and using maximum likelihood-based extraction, one gains goodness-of-fit information based on statistical theory. Standard errors, critical ratios and confidence intervals for factor loadings, and factor intercorrelations are available upon rotation. At the other extreme is confirmatory factor analysis, in which the number of factors and the pattern of loadings are specified a priori, and the full complement of fit information is available. This approach is used in the presence of stronger theory concerning the structure of the construct.

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Survey of Selected Factor Analytic Studies

Exploratory analyses. A highly cited exploratory analysis was conducted by Foa et al. (1995) using PTSD Symptom Scale interview data from a sample of female assault victims. Foa et al. performed a principal components analysis with oblique rotation to allow for correlated components. Three components were extracted and interpreted as *Arousal/Avoidance, Numbing,* and *Intrusion.* The DSM Criterion C symptoms for PTSD did not load on a common component; rather, emotional numbing was disaggregated from effortful avoidance.

Taylor et al. (1998) reported a sophisticated series of exploratory factor analyses of data from two samples: a sample of victims of motor vehicle accidents, assessed with either the Structured Clinical Interview for DSM or the Anxiety Disorders Interview Schedule, and a sample of U.N. peacekeepers assessed with the PTSD Symptom Scale, self-report format. Using common factor analysis with oblique rotation, they found two factors that were replicated over both samples, *Intrusions and Avoidance* and *Hyperarousal and Numbing.* Subsequent factor analysis of the factor scores from the initial solutions produced a single higher-order factor, again for both samples.

A recent exploratory factor analysis by Shelby et al. (2005) used data from female cancer patients' responses to the PTSD Checklist-Civilian version (PCL-C). Two-, three-, four-, and five-factor solutions were extracted via the maximum likelihood method with oblique rotation, and fit indices aided in the selection of the most appropriate solution. The researchers reasoned that this exploratory approach was desirable to determine which items loaded on which factors. A four-factor solution was judged optimal: *Reexperiencing, Avoidance, Numbing,* and *Arousal.* Once more, the avoidance and numbing symptoms did not share a common factor.

Confirmatory analyses. The first published confirmatory factor analysis of a measure of PTSD was King and King's (1994) evaluation of the dimensionality of the Mississippi Scale for Combat-Related PTSD. With a sample of male and female Vietnam theater and era veterans, they concluded that the best-fitting model was one in which four first-order factors (*Reexperiencing and Situational Avoidance, Withdrawal and Numbing, Arousal and Lack of Control,* and *Guilt and Suicidality*) were subsumed by a higher-order PTSD factor. A subsequent multigroup factor model with another similarly constituted sample demonstrated invariance or equivalence of the pattern and values of item loadings on the four factors.

The majority of confirmatory factor analyses have used measures with items that are more closely aligned to the DSM symptoms and appraised structures informed by theory and, to a certain extent, findings from prior exploratory analyses. In a study of Khmer refugees, Sack et al. (1997) followed an exploratory factor analysis of children's responses to the Diagnostic Interview for Children and Adolescents with a confirmatory factor analysis of parents' responses to the same instrument. In the confirmatory analysis, four correlated factors, *Intrusion, Numbing, Avoid-ance,* and *Arousal*, provided good fit to the data. Shortly thereafter, King et al. (1998), using data from treatment-seeking military veterans interviewed with the Clinician-Administered PTSD Scale, found support for a comparable first-order four-factor model, labeled *Reexperiencing, Effortful Avoidance, Emotional Numbing,* and *Hyperarousal.*

Four-factor solutions with an item-factor loading pattern identical to that of King et al. (1998) were endorsed by Asmundson et al. (2000) for primary care patients and Du-Hamel et al. (2004) for cancer patients, both with data from the PCL-C. The work of Amdur and Liberzon (2001) is also noteworthy. These researchers analyzed Impact of Event Scale data from military veterans presenting at a PTSD clinic. The model of best fit contained four intercorrelated factors labeled *Intrusion, Effortful Avoidance, Emotional Numbing,* and *Sleep Disturbance,* the latter factor suggestive of the more conventional arousal symptom cluster.

A variation of a four-factor model was proposed and empirically supported by Simms et al. (2002) in a sample of deployed and nondeployed Gulf War veterans who completed the PTSD Checklist-Military version (PCL-M). This model reconceptualized emotional numbing and several hyperarousal symptoms as indicators of a general distress or *Dysphoria* factor. The other three factors were *Hyperarousal* (comprised of the remaining symptoms from this cluster) and *Intrusions* and *Avoidance,* in line with the previous four-factor model. The Simms et al. model is theoretically appealing because it relates the structure of PTSD to models that delineate general and specific components of depression and anxiety.

The studies that have tested both the emotional numbing (i.e., King et al., 1998) and dysphoria (i.e., Simms et al., 2002) models have yielded mixed findings. The dysphoria model provided better fit in college students indirectly exposed to the World Trade Center attacks (Baschnagel et al., 2005) who completed the Posttraumatic Diagnostic Scale. On the other hand, McWilliams et al. (2005) found the emotional numbing model to provide better fit in community members with a history of PTSD. Here, PTSD was assessed with a modified version of the Diagnostic Interview Schedule PTSD Module. Likewise, PCL-C data from workplace sexual harassment victims supported the numbing model (Palmieri & Fitzgerald, 2005).

There are only a few studies of the structure of PTSD in children and adolescents. Using a version of the Frederick Reaction Index for Children with young victims of Hurricane Hugo, Anthony et al.(1999) judged a four-factor solution to be inadequate. The authors concluded that a hierarchical three-factor model comprised of *Intrusion/Active Avoidance, Arousal,* and *Numbing/Passive Avoidance* best fit the data, while recognizing that there was no direct test of this assertion. Factorial invariance across three age groups was demonstrated. Anthony et al. (2005) cross-validated this hierarchical three-factor model using multigroup confirmatory factor analysis with a subsample of participants from the Hurricane Hugo study and another sample of child survivors of Hurricane Andrew. They concluded that the second-order and most first-order loadings were equivalent.

Indeed, an advantage of confirmatory factor analysis is the ability to test for the invariance of a factor solution, one form being equivalence over samples. In addition to the two studies by Anthony and colleagues (Anthony et al., 1999, 2005) testing equivalence across child/adolescent samples, Norris et al. (2001) conducted an extensive investigation into the equivalence of the structure of PTSD across two samples, English-speaking US victims of Hurricane Andrew and Spanish-speaking Mexican victims of Hurricane Paulina. Using responses to abbreviated alternative-language versions of the Revised Civilian Mississippi Scale, they demonstrated configural invariance (analogous factor structures) and metric invariance (equal loadings, with the exception of one item) over the cultural groups. The best-fitting factor solution for both US and Mexican samples represented the *Intrusion, Avoidance, Numbing,* and *Arousal* aspects of PTSD, which were consistently predicted by trauma severity in both groups.

Similarly, Marshall (2004) demonstrated invariance across English-speaking and Spanish-speaking community violence victims in one large US city. The four factors of *Reexperiencing, Avoidance, Emotional Numbing,* and *Hyperarousal* and the associated pattern and strength of item loadings were the same using alternative-language versions of the PCL-C. In addition, 5 of the 6 factor intercorrelations and 16 of the 17 factor intercepts were equivalent across groups, providing evidence for the cross-cultural generalizability of the structure of PTSD. Asmundson and colleagues (2003), using the PCL-M, demonstrated reasonably sound equivalence in factor structures for UN peacekeepers with and without chronic back pain.

Conclusions and Future Directions

One firm conclusion is that there is little need for future exploratory factor analyses of PTSD measures. The abundance of analyses that have provided evidence for goodness of fit point to four factors as optimal in explaining the associations among PTSD symptoms. There may still be debate as to higher-order factors versus correlated first-order factors and with regard to the specific pattern of item loadings, but confirmatory analyses offer the best investment for future gains.

The current DSM-IV amalgamation of avoidance and numbing within a single symptom cluster needs to be reconsidered. The vast majority of analyses, including those using measures with items that do not strictly map onto the DSM framework, have supported the separation of these two elements.

Relatedly, the jury is still out on the merits of the Simms et al. (2002) four-factor model versus one more closely aligned to the DSM-based representation of PTSD. Generally, the confirmatory fit indices for these models have been very close and conclusions have varied. This introduces opportunities for creative resolution and calls for more sophisticated PTSD research in which dimensions of mood and other anxiety disorders are incorporated to better elucidate the structure and placement of PTSD.

More studies are needed that seek information about invariance or consistency of latent structure over samples representing different populations: different trauma groups; different racial, ethnic, or cultural groups; over gender; over age groups; and so on. In addition, studies of invariance over occasions are required to accommodate the growing body of longitudinal PTSD research, including new ecological proximal assessment approaches using modern data recording devices, with participants providing dense time series data to inform the course of PTSD. In this regard, we recommend the implementation of longitudinal dynamic factor analysis models to map the structure of PTSD as a process following trauma exposure and over time.

SELECTED ABSTRACTS

AMDUR, R.L., & LIBERZON, I. (2001). **The structure of posttraumatic stress disorder symptoms in combat veterans: A confirmatory factor analysis of the Impact of Event Scale.** *Journal of Anxiety Disorders, 15,* 345-357. There has been controversy over the most appropriate way to define symptom clusters for PTSD. We tested the factor structure of the Impact of Event Scale (IES) in a sample of 195 male combat veterans with chronic PTSD by using confirmatory factor analysis. The two-factor model including Intrusion (i.e., unwanted memories of the event) and Avoidance (i.e., attempts to avoid reminders and numbing of emotional responsiveness) deviated significantly from good fit. However, a four-factor model, including Intrusion and Effortful Avoidance subscales, as well as Sleep Disturbance and Emotional Numbing subscales, fit significantly better. Correlations with other PTSD measures are explored and implications for the conceptualization of PTSD are discussed.

ANTHONY, J.L., LONIGAN, C.J., & HECHT, S.A. (1999). **Dimensionality of posttraumatic stress disorder symptoms in children exposed to disaster: Results from confirmatory factor analyses.** *Journal of Abnormal Psychology, 108,* 326-336. Factor analytic studies of trauma victims' PTSD have offered conflicting hypotheses about how to conceptualize PTSD into symptom categories. The present study used confirmatory factor analyses of the self-reported PTSD symptomatology from 5,664 child and adolescent victims of Hurricane Hugo to compare 10 models of PTSD dimensionality. PTSD was best represented by a 2nd-order PTSD factor that manifests in 3 symptom clusters (Intrusion/Active Avoidance, Numbing/Passive Avoidance, and Arousal). This model was cross-validated on 3 age groups (late childhood, early adolescence, and late adolescence), and results indicated factorial invariance across groups. PTSD symptoms varied in relative centrality to the underlying dimensions of PTSD, which differed.

ANTHONY, J.L., LONIGAN, C.J., VERNBERG, E.M., LA GRE-CA, A.M., SILVERMAN, W.K., & PRINSTEIN, M.J. (2005). **Multi-sample cross-validation of a model of childhood posttraumatic stress disorder symptomatology.** *Journal of Traumatic Stress, 18,* 667-676. This study is the latest advancement of our research aimed at best characterizing children's posttraumatic stress reactions. In a previous study, we compared existing nosologic and empirical models of PTSD dimensionality and determined the superior model was a hierarchical one with three symptom clusters (Intrusion/Active Avoidance, Numbing/Passive Avoidance, and Arousal). In this study, we cross-validate this model in two populations. Participants were 396 fifth graders who were exposed to either Hurricane Andrew or Hurricane Hugo. Multisample confirmatory factor analysis demonstrated the model's factorial invariance across populations who experienced traumatic events that differed in severity. These results show the model's robustness to characterize children's posttraumatic stress reactions. Implications for diagnosis, classification criteria, and an empirically supported theory of PTSD are discussed.

ASMUNDSON, G.J.G., FROMBACH, I., MCQUAID, J., PEDRELLI, P., LENOX, R., & STEIN, M.B. (2000). **Dimensionality of posttraumatic stress symptoms: A confirmatory factor analysis of DSM-IV symptom clusters and other symptom models.** *Behaviour Research and Therapy, 38,* 203-214. Recent exploratory and confirmatory factor analytic investigations suggest that the 3 symptom clusters of PTSD as defined in DSM-IV may not provide the best conceptualization of symptom dimensionality. However, the alternative models have not been in agreement, nor have they been compared against each other or models based on the DSM-IV. The purpose of the present investigation was to test a series of dimensional models suggested by these recent factor analytic investigations and the DSM-IV. Using data collected with the PTSD Checklist-Civilian Version from 349 referrals to a primary care medical clinic, we used confirmatory factor analysis to evaluate a: (1) hierarchical four-factor model, (2) four-factor intercorrelated model, (3) hierarchical three-factor model, (4) three-factor intercorrelated model, and (5) hierarchical two-factor model. The hierarchical four-factor model (comprising four first-order factors corresponding to reexperiencing, avoidance, numbing and hyperarousal all subsumed by a higher-order general factor) provided the best overall fit to the data, although, all models met some standards specified for good model fit. More research is needed to establish the dimensional nature of PTSD symptoms and to assess whether identified dimensions differ as a function of the trauma experience. Implications for assessment, diagnosis, and treatment are also discussed.

ASMUNDSON, G.J.G., WRIGHT, K.D., MCCREARY, D.R., & PEDLAR, D. (2003). **Post-traumatic stress disorder symptoms in United Nations peacekeepers: An examination of factor structure in peacekeepers with and without chronic pain.** *Cognitive Behaviour Therapy, 32,* 26-37. Recent factor analytic investigations of PTSD in military veterans suggest that symptoms are best described by either a hierarchical 2-factor model or a 4-factor inter-correlated model. Other recent evidence suggests that PTSD and chronic pain are intricately related; however, the nature of this relationship is not well understood. Factor analysis provides one method for clarifying this relationship. In study 1, we compared competing models of PTSD symptom structure in a sample of 400 male United Nations peacekeepers using confirmatory factor analysis. Results indicated that both the hierarchical 2-factor and the 4-factor inter-correlated models provided good fit to the data. In study 2, the reliability of these models was assessed in 427 male United Nations peacekeepers with chronic back pain and 341 without. Group comparisons of the confirmatory factor analysis results revealed that the structure of the hierarchical 2-factor and 4-factor inter-correlated models both provided good fit to the data in both the chronic back pain and the group without. However, the structure of the models for the group with chronic back pain differed in significant ways from that of the group without chronic back pain. PTSD symptoms in military veterans can be adequately conceptualized using either a hierarchical 2-factor or 4-factor inter-correlated model. Chronic pain has minimal influence on overall factor structure. The hierarchical 2-factor model, while parsimonious, does not provide the degree of symptom detail provided by the 4-factor inter-correlated model. Implications for conceptualization of PTSD symptoms for patients with chronic back pain and significant PTSD symptomatology are discussed.

BASCHNAGEL, J.S., O'CONNOR, R.M., COLDER, C.R., & HAWK, L.W. (2005). **Factor structure of posttraumatic stress among Western New York undergraduates following the September 11th terrorist attack on the World Trade Center.** *Journal of Traumatic Stress, 18,* 677-684. The structure of posttraumatic stress is of both theoretical and clinical interest. In the present study, seven models of posttraumatic stress were compared using confirmatory factor analysis. A sample of 528 Western New York undergraduate students was assessed 1 and 3 months after the September 11th, 2001 terrorist attacks. At the Month 1 assessment, the current three-factor DSM-IV model, which consists of Intrusions, Avoidance/Numbing, and Hyperarousal, did not provide a good fit to the data; however, a four-factor model consisting of factors labeled Intrusions, Avoidance, Dysphoria, and Hyperarousal did fit the data well and provided better fit than the three-factor model and other competing models. Importantly, Dysphoria spans symptoms from the traditional DSM Numbing and Hyperarousal clusters. The four-factor model continued to fit the data well at Month 3. These findings parallel the results of earlier studies which suggest that a four-factor model better reflects the nature of posttraumatic stress than do simpler models, including the DSM. The present work is consistent with a dimensional model of stress responses and calls for further longitudinal work in this area.

DUHAMEL, K.N., OSTROFF, J., ASHMAN, T., WINKEL, G., MUNDY, E.A., KEANE, T.M., ET AL. (2004). **Construct validity of the Posttraumatic Stress Disorder Checklist in cancer survivors: Analyses based on two samples.** *Psychological Assessment, 16,* 255-266. The measurement of PTSD is critically important for the identification and treatment of this disorder. The PTSD Checklist (PCL) is a self-report measure that is increasingly used. In this study, the authors investigated the factorial validity of the PCL with data from 236 cancer survivors who received a bone marrow or stem cell transplantation. The authors examined the fit of these data with the clinical model of 3 symptom clusters for PTSD, as proposed in the DSM-IV, and alternative models tested in prior research. By using confirmatory factor analysis the authors found that a 4-first-order-factor model of PTSD provided the best fit. The relations of PTSD symptoms with sociodemographic and medical variables were also explored.

FOA, E.B., RIGGS, D.S., & GERSHUNY, B.S. (1995). **Arousal, numbing, and intrusion: Symptom structure of PTSD following assault.** *American Journal of Psychiatry, 152,* 116-120. *Objective:*

This study investigated hypotheses concerning the importance of symptoms of numbing in PTSD. *Method:* Symptoms of PTSD were assessed in 72 female rape victims and 86 female victims of nonsexual assault approximately 3 months after the crimes occurred. A principal-components factor analysis of subjects' symptoms was then undertaken. *Results:* The analysis yielded three factors: arousal/avoidance, numbing, and intrusion. These were somewhat different from the symptom clusters in DSM-III-R, since effortful avoidance and numbing symptoms did not load on the same factor. Numbing symptoms appeared to be particularly important in identifying individuals with PTSD. *Conclusions:* The results imply that there are two patterns of posttrauma symptoms, one characterizing PTSD and the second characterizing a phobic reaction.

KING, D.W., LESKIN, G.A., KING, L.A., & WEATHERS, F.W. (1998). **Confirmatory factor analysis of the Clinician-Administered PTSD Scale: Evidence for the dimensionality of posttraumatic stress disorder.** *Psychological Assessment, 10,* 90-96. The Clinician-Administered PTSD Scale is a structured interview that assesses the 17 key symptoms of PTSD as established in DSM-IV. CAPS data from 524 treatment-seeking male military veterans were submitted to confirmatory factor analysis to test a series of nested models reflecting alternative representations of PTSD dimensionality: (a) a 4-factor, 1st-order solution; (b) a 2-factor, higher order solution; (c) a single-factor, higher order solution; and (d) a single-factor, 1st-order solution. The model of best fit was the 4-factor, 1st-order solution, containing moderately to highly correlated yet distinct 1st-order factors corresponding to the reexperiencing, effortful avoidance, emotional numbing, and hyperarousal aspects of PTSD. Implications for theory, assessment, and future research are presented in this article.

KING, L.A., & KING, D.W. (1994). **Latent structure of the Mississippi Scale for Combat-Related Post-Traumatic Stress Disorder: Exploratory and higher-order confirmatory factor analyses.** *Assessment, 1,* 275-291. A series of factor analyses evaluated the dimensionality of the Mississippi Scale for Combat-Related Post-Traumatic Stress Disorder. Over 2,200 Vietnam theater and era veterans were divided into 3 random subsamples, each of which was used in a separate stage of analysis. Initial exploratory factor analyses suggested an underlying single-factor solution. In the second subsample, a second-order solution comprised of a general factor subsuming several first-order factors was supported using chi-square difference testing. This model was successfully replicated with the third subsample. Cumulative evidence suggests that the latent structure of the Mississippi Scale is best represented as an umbrella PTSD factor leading to 4 subsidiary facets or dimensions.

MARSHALL, G.N. (2004). **Posttraumatic Stress Disorder Symptom Checklist: Factor structure and English-Spanish measurement invariance.** *Journal of Traumatic Stress, 17,* 223-230. This study used confirmatory factor analysis to compare alternative models of the structure of posttraumatic distress symptoms as measured by the Posttraumatic Stress Disorder Checklist-Civilian version (PCL-C). Data were derived from English- (N = 299) and Spanish-speaking (N = 120) samples of young adult survivors of community violence recruited following hospitalization for physical injuries. The best fit to the data was a four-factor model measuring correlated dimensions of reexperiencing, avoidance, emotional numbing, and hyperarousal. English- and Spanish-language versions of the PCL-C showed general measurement equivalence.

MCWILLIAMS, L.A., COX, B.J., & ASMUNDSON, G.J.G. (2005). **Symptom structure of posttraumatic stress disorder in a nationally representative sample.** *Journal of Anxiety Disorders, 19,* 626-641. Diagnostic criteria (e.g., DSM-IV) for PTSD posit 3 symptom clusters including reexperiencing, avoidance/numbing, and hyperarousal. Factor analytic studies have suggested several alternative models of PTSD symptomatology. It is uncertain whether these new models are widely generalizable as most studies have relied on relatively select treatment seeking samples (e.g., combat veterans). To address this limitation, confirmatory factor analysis was applied to symptom data from National Comorbidity Survey (NCS) respondents with a lifetime history of PTSD ($n = 429$). Several models were tested. The model comprised of 4 intercorrelated factors (reexperiencing, avoidance, numbing, and hyperarousal) received the strongest support, but did not meet all the goodness-of-fit criteria. A follow-up principal-components analysis yielded a 4-factor solution, with factors representing dysphoria, cued reexperiencing and avoidance, uncued reexperiencing and hyperarousal, and trauma-related rumination. The theoretical and clinical implications of these findings are discussed.

NORRIS, F.H., PERILLA, J.L., & MURPHY, A.D. (2001). **Post-disaster stress in the United States and Mexico: A cross-cultural test of the multicriterion conceptual model of posttraumatic stress disorder.** *Journal of Abnormal Psychology, 110,* 553-563. Data on symptoms of PTSD were collected 6 months after Hurricanes Paulina *(n = 200;* Mexico) and Andrew (non-Hispanic *n =* 270; United States) using the Revised Civilian Mississippi Scale. A 4-factor measurement model that represented the accepted multicriterion conceptualization of PTSD fit the data of the U.S. and Mexican samples equally well. The 4 factors of Intrusion, Avoidance, Numbing, and Arousal correlated significantly and equivalently with severity of trauma in each sample. A single construct explained much of the covariance of the symptom factors in each sample. However, modeling PTSD as a unidimensional construct masked differences between samples in symptom severity. With severity of trauma controlled, the Mexican sample was higher in Intrusion and Avoidance, whereas the U.S. sample was higher in Arousal. The results suggest that PTSD is a meaningful construct to study in Latin American societies.

PALMIERI, P.A., & FITZGERALD, L.F. (2005). **Confirmatory factor analysis of posttraumatic stress symptoms in sexually harassed women.** *Journal of Traumatic Stress, 18,* 657-666. PTSD factor analytic research to date has not provided a clear consensus on the structure of posttraumatic stress symptoms. Seven hypothesized factor structures were evaluated using confirmatory factor analysis of the Posttraumatic Stress Disorder Checklist, a paper-and-pencil measure of posttraumatic stress symptom severity, in a sample of 1,218 women who experienced a broad range of workplace sexual harassment. The model specifying correlated re-experiencing, effortful avoidance, emotional numbing, and hyperarousal factors provided the best fit to the data. Virtually no support was obtained for the DSM-IV three-factor model of re-experiencing, avoidance, and hyperarousal factors. Different patterns of correlations with external variables were found for the avoidance and emotional numbing factors, providing further validation of the supported model.

SACK, W.H., SEELEY, J.R., & CLARKE, G.N. (1997). **Does PTSD transcend cultural barriers? A study from the Khmer Adolescent Refugee Project.** *Journal of the American Academy of Child and Adolescent Psychiatry, 36,* 49-54. *Objective:* To determine

whether the factor structure of the PTSD syndrome in Cambodian refugee youth resembles earlier reported factor studies in Caucasian samples. *Method*: 194 Khmer adolescent refugees who reported prior significant trauma (most of it massive war trauma as children) were administered the PTSD module of the Diagnostic Interview for Children and Adolescents, as part of an epidemiological study on the effects of war on this group of refugees. *Results:* The following 4 factors were found: arousal, avoidance, intrusion, and numbing. A confirmatory factor analysis using data from the parents of this sample yielded a good fit for the 4-factor solution based on the youth data. *Conclusions:* The 4-factor solution from this sample resembled earlier studies on traumatized Caucasian and African-American adults. These results lend further credibility to the veracity of this diagnosis with refugee samples. PTSD as a result of prior war trauma appears to surmount the barriers of culture and language in this sample.

SHELBY, R.A., GOLDEN-KREUTZ, D.M., & ANDERSEN, B.L. (2005). **Mismatch of posttraumatic stress disorder (PTSD) symptoms and DSM-IV symptom clusters in a cancer sample: Exploratory factor analysis of the PTSD Checklist-Civilian Version.** *Journal of Traumatic Stress, 18,* 347-357. The DSM-IV conceptualization of PTSD includes three symptom clusters: reexperiencing, avoidance/numbing, and arousal. The PTSD Checklist-Civilian Version (PCL-C) corresponds to the DSM-IV PTSD symptoms. In the current study, we conducted exploratory factor analysis (EFA) of the PCL-C with two aims: (a) to examine whether the PCL-C evidenced the three-factor solution implied by the DSM-IV symptom clusters, and (b) to identify a factor solution for the PCL-C in a cancer sample. Women (N = 148) with Stage II or III breast cancer completed the PCL-C after completion of cancer treatment. We extracted two-, three-, four-, and five-factor solutions using EFA. Our data did not support the DSM-IV PTSD symptom clusters. Instead, EFA identified a four-factor solution including reexperiencing, avoidance, numbing, and arousal factors. Four symptom items, which may be confounded with illness and cancer treatment-related symptoms, exhibited poor factor loadings. Using these symptom items in cancer samples may lead to overdiagnosis of PTSD and inflated rates of PTSD symptoms.

SIMMS, L.J., WATSON, D., & DOEBBELING, B.N. (2002). **Confirmatory factor analysis of posttraumatic stress symptoms in deployed and nondeployed veterans of the Gulf War**. *Journal of Abnormal Psychology, 111,* 637-647. Confirmatory factor analysis was used to compare 6 models of PTSD symptoms, ranging from 1 to 4 factors, in a sample of 3,695 deployed Gulf War veterans (N = 1,896) and nondeployed controls (N = 1,799). The 4 correlated factors — intrusions, avoidance, hyperarousal, and dysphoria — provided the best fit. The dysphoria factor combined traditional markers of numbing and hyperarousal. Model superiority was cross-validated in multiple subsamples, including a subset of deployed participants who were exposed to traumatic combat stressors. Moreover, convergent and discriminant validity correlations suggested that intrusions may be relatively specific to PTSD, whereas dysphoria may represent a nonspecific component of many disorders. Results are discussed in the context of hierarchical models of anxiety and depression.

TAYLOR, S., KUCH, K., KOCH, W.J., CROCKETT, D.J., & PASSEY, G. (1998). **The structure of posttraumatic stress symptoms.** *Journal of Abnormal Psychology, 107,* 154-160. PTSD, as defined by DSM-III-R and DSM-IV, is characterized by 17 symptoms, descriptively clustered into 3 groups: (a) intrusions, (b) hyperarousal, and (c) avoidance and numbing. The present study sought to identify the basic dimensions (factors) that underlie these symptoms. 2 samples were assessed: 103 victims of motor vehicle accidents and 419 United Nations peacekeepers deployed in Bosnia. A principal axis factor analysis was conducted for each sample. In each sample, 2 correlated factors were obtained, which were very similar across samples. Factor 1 was labeled Intrusions and Avoidance, and Factor 2 represented Hyperarousal and Numbing. These factors loaded on a single higher order factor. The higher order factor accounted for 13 percent to 38 percent of variance in symptom severity, and the lower order factors accounted for an additional 8 percent to 9 percent of variance. If the authors assume that each factor corresponds to a distinct mechanism, then the results suggest that posttraumatic stress reactions arise from a general mechanism, with contributions from 2 specific mechanisms.

MEASURES CITED

Anxiety Disorders Interview Schedule—revised (ADIS-R). DiNardo, P.A., & Barlow, D.H. (1988). Albany, N.Y.: Phobia and Anxiety Disorders Clinic, Center for Stress and Anxiety Disorders, State University of New York at Albany

Clinician-Administered PTSD Scale. Blake, D.D., Weathers, F.W., Nagy, L.M., Kaloupek, D.G., Klauminzer, G., Charney, D.S., & Keane, T.M. (1990). **A clinician rating scale for assessing current and lifetime PTSD: The CAPS-1.** *The Behavior Therapist, 13,* 187-188.

Diagnostic Interview for Children and Adolescents. Welner, Z., Reich, W., Herjanic, B., Jung, K.G., & Amado, H. (1987). **Reliability, validity, and parent-child agreement studies of the Diagnostic Interview for Children and Adolescents (DICA).** *Journal of the American Academy of Child and Adolescent Psychiatry, 26,* 649-653.

Diagnostic Interview Schedule PTSD Module (modified version). Breslau, N., Davis, G.C., Andreski, P., & Peterson, E. (1991). **Traumatic events and posttraumatic stress disorder in an urban population of young adults.** *Archives of General Psychiatry, 48,* 216-222.

Frederick Reaction Index for Children. Frederick, C.J. (1985). **Children traumatized by catastrophic situations**. In S. Eth & R.S. Pynoos (Eds.), *Post-traumatic stress disorder in children* (pp. 71-99). Washington, DC: American Psychiatric Press.

Impact of Event Scale. Horowitz, M., Wilner, N., & Alvarez, W. (1979). **Impact of Event Scale: A measure of subjective distress.** *Psychosomatic Medicine, 41,* 209-218.

Mississippi Scale for Combat-related PTSD. Keane, T.M., Caddell, J.M., & Taylor, K.L. (1988). **Mississippi Scale for Combat-Related Posttraumatic Stress Disorder: Three studies in reliability and validity.** *Journal of Consulting and Clinical Psychology, 56,* 85-90.

Posttraumatic Diagnostic Scale. Foa, E.B., Cashman, L., Jaycox, L., & Perry, K. (1997). **The validation of a self-report measure of posttraumatic stress disorder: The Posttraumatic Diagnostic Scale.** *Psychological Assessment, 9,* 445-451.

PTSD Checklist. Weathers, F.W., Litz, B.T., Herman, D.S., Huska, J.A., & Keane, T.M. (1993, October). *The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility.* Paper presented at the annual meeting of the International Society for Traumatic Stress Studies, San Antonio, TX.

PTSD Symptom Scale. Foa, E.B., Riggs, D.S., Dancu, C.V., & Rothbaum, B.O. (1993). **Reliability and validity of a brief instrument for assessing post-traumatic stress disorder.** *Journal of Traumatic Stress, 6,* 459-473.

Revised Civilian Mississippi Scale for PTSD. Norris, F.H., & Perilla, J.L. (1996). **The Revised Civilian Mississippi Scale for PTSD: Reliability, validity, and cross-language stability.** *Journal of Traumatic Stress, 9,* 285-298.

Structured Clinical Interview for DSM-III-R. Spitzer, R.B., Williams, J.B.W., Gibbon, M., & First, M.B. (1990). *Structured Clinical Interview for DSM-III-R. Patient Edition.* Washington, DC: American Psychiatric Press.

RESOURCES FOR FACTOR ANALYSIS

BROWN, T.A. (2006). *Confirmatory factor analysis for applied research.* New York: Guilford.

This book seeks to translate complex material to the applied researcher. In addition to the conceptual and theoretical background necessary for an understanding of confirmatory factor analysis, many practical examples are offered, and accompanying data sets and software syntax for various structural equation modeling programs are provided.

BROWNE, M.W., & NESSELROADE, J.R. (2005). **Representing psychological processes with dynamic factor models: Some promising uses and extensions of Autoregressive Moving Average time series models.** In A. Maydeu-Olivares & J.J. McArdle (Eds.). *Contemporary psychometrics: A festschrift for Roderick P. McDonald* (pp. 415-452). Mahwah, NJ: Erlbaum.

The authors introduce the notion of time series models as applied to contemporary psychological inquiry that has become more focused on process-oriented and densely and repeatedly measured observations. Following descriptions of basic autoregressive and moving average models, the article proceeds to an explanation of two dynamic factor analysis models.

FABRIGAR, L.R., WEGENER, D.T., MACCALLUM, R.C., & STRAHAN, E.J. (1999). **Evaluating the use of exploratory factor analysis in psychological research.** *Psychological Methods, 4,* 272-299.

This article provides a comprehensive review of the use of exploratory factor analysis in psychological research. It overviews the decisions that need to be made and demonstrates how poor decision-making can lead to incorrect findings. A perusal of two prominent journals shows that inadequate practices persist in the realm of exploratory factor analysis.

FLOYD, F.J., & WIDAMAN, K.F. (1995). **Factor analysis in the development and refinement of clinical assessment instruments.** *Psychological Assessment, 7,* 286-299.

This article provides an excellent discussion of the distinction between exploratory and confirmatory factor analysis. Placing the role of factor analysis in the development of clinical instruments, guidelines for conducting and reporting the results of factor analyses are detailed.

KING, L.A., ORCUTT, H.K., & KING, D.W. (2002). **Gender differences in stress, trauma, and PTSD research: Application of two quantitative methods.** In R. Kimerling, P.C. Ouimette, & J. Wolfe (Eds.). *Gender and PTSD* (pp. 403-433). New York: Guilford.

In the context of using gender as a moderator variable in PTSD research, the authors discuss multiple group confirmatory factor analysis. They explain the concept of invariance and recommend means by which invariance of a latent structure can be demonstrated. Examples using actual data are developed.

LOEHLIN, J.C. (2004). *Latent variable models: An introduction to factor, path, and structural equation analysis (4th Ed.).* Mahwah, NJ: Erlbaum.

This is a very accessible text for understanding the basics of structural equation modeling, to include factor analysis. The author makes use of path diagrams to introduce and explain concepts. The newest edition contains a section on factorial invariance, and a data CD is available to enhance the presentation of examples in the chapters.

MCARDLE, J.J. (1996). **Current directions in structural factor analysis.** *Current Directions in Psychological Science, 5,* 11-18.

This brief article provides a user-friendly introduction to more modern methods of factor analysis using graphical representations via path diagrams to explain the strengths of confirmatory or structural factor analysis. Examples related to construct validation, multiple groups factor consistency or invariance, and growth factors to accommodate longitudinal models are presented.

PREACHER, K.J., & MACCALLUM, R.C. (2003). **Repairing Tom Swift's electric factor analysis machine.** *Understanding Statistics, 2,* 13-43.

This article reviews common practices in conducting exploratory factor analyses and identifies a series of errors in judgment that are frequently made by researchers. Critical decisions include what model to employ, number of factors to extract, type of rotation, and threshold for salient loadings. The authors make a strong case for common factor analysis over principal components analysis.

PILOTS UPDATE

We have just completed a revision of the PILOTS Thesaurus, the controlled vocabulary that we use to describe the subject matter of the publications that we index in the PILOTS Database. The first version of the PILOTS Thesaurus, published in 1991, contained 709 descriptors; this fourth version contains more than 1200. The 500 descriptors that we have added over the past 15 years reflect the widening scope of traumatic stress studies and the increasing number of disciplines from which contributions to the traumatic stress literature are emerging. We have also made a few changes and deletions as we attempt to keep our indexing vocabulary up to date.

Many of the new descriptors represent national and ethnic groups on which studies are beginning to appear. Anticipating further expansion of the psychotrauma literature, we have added descriptors for every nationality listed in the *World Factbook,* our authority for such names. With issues surrounding migration and acculturation becoming more prominent, we are adding terms for Immigrant Americans, Immigrant Australians, and Immigrant Canadians. As literature on the consequences of migration to other countries increases, we shall consider other potential descriptors.

We have added descriptors for several occupational groups, such as Composers, Foreign Service Personnel, Human Rights Workers, Interpreters, Performing Artists, and Research Personnel; and for Grandparents, Shelter Residents, Transgendered Persons, and Transsexuals. In some cases these new terms reflect research and publishing patterns, and in other cases they are intended to anticipate them.

New classes of traumatic events represented in our thesaurus include Caregiver Impairment, Dating Violence, Death of Public Figure, Deprogramming, Disability, Mass Homicide, Poverty, Resource Loss, School Violence, Sibling Abuse, and Trafficking. In addition, we continue to use the names of individual disasters and other traumatic incidents in our indexing, standardizing the forms of these names to help searchers find all papers relevant to a particular incident.

The consequences of those events require new terms as well, and we have added Child Sexual Abuse Accommodation Syndrome, Neuroticism, Occupational Performance, Resource Loss, and Treatment Compliance to describe them.

New descriptors for Acute Stress Disorder Assessment Instruments and Dissociation Assessment Instruments, and for Antibiotic Drugs, Animal Assisted Therapy, Energy Psychotherapy, Individual Psychotherapy, Lateral Visual Stimulation, Narrative Exposure Therapy, Peer Counseling, School Based Treatment, and Therapeutic Physical Exercise, should make it easier to find literature on specific assessment and treatment options.

We revise the indexing of publications already included in the PILOTS Database whenever we make changes to the Thesaurus. This ensures that any search employing new descriptors will retrieve older papers as well as those newly indexed. As always, our goal is to make it as easy as possible for PILOTS Database users to find the publications they need.

Another step toward this goal is the continuing addition of links to the full text of papers that we have indexed. We have been able to add 2000 of these because several major publishers have undertaken extensive retrospective digitization of their journals. Identifying these and adding them to PILOTS Database records is a tedious process, requiring the manual revision of each affected record; but it will make it much easier for database users to obtain the complete content as well as the essential bibliographic and descriptive information for the papers their searches uncover.

In the near future many PILOTS Database users will encounter additional assistance in locating full text. Many libraries have incorporated aids to finding desired publications into their online catalogs, which automatically direct their affiliated users to the best sources. This minimizes the possibility that users will be asked to pay for access to material that their institutions can provide free of charge. As these links are provided by the participating libraries, not by the PILOTS Database, we have no control over whether these exist or how they function in any particular case. Similarly, we have no control over the policies that publishers establish for access to their books and journals, nor over the prices that they may charge.

We expect to announce more substantial improvements to the PILOTS Database in the near future. Watch this space!

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